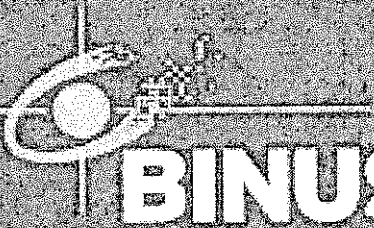


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**MANAGEMENT
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PROCEEDINGS

INTERNATIONAL SEMINAR 2008

Optimizing Business Research and Information Technology
for Leveraging Corporate Sustainability

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INVENTORY MANAGEMENT OF FLOWERS AT THE FLOWER MAN

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ABSTRACT

Value Stream Management is a new strategic and operational approach to the data capture, analysis, planning and implementation of effective change within the core processes required to achieve a truly lean enterprise. The new approach involves a strategic review of a business or supply chain's activities, the delimitation of key processes and the mapping of these processes (Russell et al, 2003). Critically analysing The Flower Man enabled the detection of inherent problems with the current inventory management strategies.

Certain problems were highlighted during this analysis. Due to a lack of a disciplined approach employed by management to determine the daily order quantity, highly fluctuating demand of flowers make the ordering process more difficult as forecasting process needs to be more accurate to accommodate these demands. Also, given the highly perishable nature of roses, storage problem increases the risk of high wastes if the flowers are not stored in suitable conditions. With an excess or shortage in the supply of their products, the florist risks losing its revenue to its rivals operating within close vicinity.

The following report aims to identify the main issues affecting the florist and propose solutions to assist with the operations of The Flower Man in regards to the management of its inventory system. By basing our review on the Project Improvement Model (Finch, 2006), we examined sales data for a period of 10 weeks to gain an understanding of the effects of the current demand on the wastage of flowers. We came to the conclusion that implementation of a fixed interval, variable-quantity system was most feasible. We also found that the utilization of a refrigeration system for the storage of flowers extended the shelf life of the products enhancing quality and further reducing wastage.

After analysing and implementing the practical implications of the recommended process improvements, we found that The Flower Man could increase its profitability by improving in two areas; maintaining the high degree of quality of their products and lowering the wastage problem. Moreover, our recommendations have enhanced the ability of the florist to deliver its value attributes to customer.

Keywords: Inventory management, value stream management, Project improvement model

INTRODUCTION

The Flower Man is a sole proprietary florist founded by Thomas Sergi. The first store was established in Kingscross in 1948. Our key focus will be placed on The Flower Man located in the foodhall of David Jones Department Store in Pitt Street Mall. The Flower Man have recently been facing some inventory management issues with the high quantity of flower wastage. In order to cater the demand of the customer, the business has been ordering too many flowers. Every morning, the manager orders flowers from the flower market and at the end of the day, wilted and damaged flowers will be discarded off the shelf. This has resulted in stock surpluses within the company. Wastage reduces the efficiency in its operation and will deter the profitability of The Flower Man.

Flower longevity is a major issue for this company. Due to the perishable nature of the flower, some will be thrown away (Janson, 1987). Flowers has a short live span, this means that at the end of the day, unsold flowers will be discarded. It is essential that the company deliver fresh flowers to the customer, the company has been known for its quality of the flowers and its service. The quality of the flower will directly affect the profitability of the company.

Without a clear understand on how the demand of flowers fluctuates, it is difficult for the manager to estimate the quantity of order. It is important for them to order the correct amount of flower to decrease wastage and increase efficiency of its operation. Lower wastage and higher efficiency will resulted in higher level of profitability

From our process analysis of this company, we will try to achieve two important objectives of inventory management process:

1. To reduce waste as much as possible
2. To increase the quality and freshness of the flowers

Achieving these two objectives will be hard but not impossible. In understanding the current wastage problem, we will able to improve inventory management system at The Flower Man. A decrease in waste and higher quality of the flower would result in higher revenue thus increasing the success of the company.

AN OVERVIEW OF THE FLOWER MAN

The Flower Man is open seven days a week, Monday to Sunday 9:30am to 6:00pm. The store was founded in 1948 and has since expanded to eight different stores nationwide. A wide variety of flowers are sold at the florist:

Roses
 Gerberas
 Lillies
 Orchids
 Australian Natives
 Gardenias
 Carnations
 Daffodils

Customers have the option to purchase the flowers as singles, dozens or have them arranged in baskets, bouquets and boxes. The Flower Man targets local residents who are regular shoppers at David Jones and have thus become loyal customers of the department store. Also, metropolitan workers in the heart of Sydney's Central Business District make up a large portion of the stores customers.

Through a differentiation strategy, The Flower Man positions itself away from the other similar and competing stores in the metropolitan vicinity by maintaining a high level of product quality. This high quality attribute may be classified as an 'order winner' to its customers, as this characteristic has played a major role in the company maintaining its level of profitability, whilst setting it apart from growing competitive pressures. Customers acknowledge this through their 48 hour guarantee policy, as stated on their website ;

"if your flowers wilt within 48 hours of delivery, and you've looked after them according to the care instructions, just return them to us and we will supply you with new flowers.." (The Flower Man, 2007)

Order Qualifiers are necessary product characteristics, yet insufficient to secure a sale (Gaither & Frazier, 2002). The characteristics prevalent at the florist the speed and promptness of processing the product (response time), the time and place set for delivery is followed through (dependability of delivery) and geographical positioning of the store creates value for customers through ease and convenience of access by David Jones' customers (convenience). While it is necessary to provide fast delivery service to customers for these products, it is insufficient to generate sales as the majority of customers make in-store pickup purchases.

To ensure that order winners and qualifiers remain consistent with their products, The Flower Man focuses on achieving the following functional goals:

- Achieving weekly sales targets
- Upholding reputation for freshness and quality flowers
- Maintaining minimal inventory levels
- Minimising wastage
- Achieving product quality controls
- Achieving fast delivery service

THE CURRENT INVENTORY MANAGEMENT PROCESS

The current inventory management process at The Flower Man is demonstrated in the following blueprint. The blueprint illustrates the steps taken to manage the stock from the time it reaches the florist from the supplier to when the customer exchanges the product for a payment. The main steps are outlined below.

Step 1: The owner of The Flower Man at the Surry Hills Head Office collects inventory from its suppliers at 6am in the morning.

Step 2: Inventory orders from the previous day are then dispatched to the respective florist stores through Mail Core Courier Company.

Step 3: When the store receives the order, the manager checks the invoice to ensure the amount ordered is consistent with the amount delivered. If the quantity is accurate, the manager displays flowers at the shop front. Between steps two and three, there is a potential *fail point* here, as the wrong amount could be dispatched from the head office. There is also a *wait point* stemming from the time lapse between the time the order is dispatched to when it is received.

This signals the end point of the ordering process for the manager and the ordering process for the customer begins here.

Step 4: The customer places an order, which will consist of either a straight purchase of flowers at the shop front or pre-ordered flower arrangements. Stock availability is checked in the store before the order is processed. The *fail point* here is due to the possibility of a shortage in stock. If this is the case, the order is faxed to the Head Office who will then process the order.

Step 5: If stock is available, order is processed by the in-store florist immediately.

The *fail point* here involves recording an incorrect order or the order form is not successfully faxed to the head office which results in the product not being processed. The *wait time* involves the time it takes the product to reach the customer from the time it is ordered.

Step 6: The transaction is then put through the register and the customer pays for the product through cash/credit/Debit card. (Cost will consist of a delivery charge if applicable). Customer receives product upon pickup or delivery of the product.

At the end of the day, the following steps are taken:

Step 7: The manager counts and records the quantity of stock left at the end of the day.

Step 8: The manager disposes the damaged and wilted stock & waters the leftover stock to preserve it for the next few working days.

Step 9: The manager then faxes an inventory order invoice to the Head Office for stock required in the next working day.

AN ANALYSIS OF THE OPERATIONS PROBLEM AT THE FLOWER MAN

The Flower Man is currently facing inventory management problems, where the absence of a quantitative understanding of how demand of its flowers fluctuates has created disequilibrium between inventory supply and demand. It is difficult to accurately forecast how much to order from suppliers due to demand fluctuations in response to seasons and occasions (Dolgui and Pashkevich, 2007). It is of fundamental significance that an organisation determines an optimal amount of stock to achieve high customer service level while also reducing carrying costs and stock out costs (Hawkins 2003).

Due to the lack of a disciplined approach to demand forecasting, another problem of increasing wastages of flowers has affected The Flower Man's performance. The absence of an effective inventory storage method is the main cause of the wastage problem in times when there is excess inventory. Due to the perishable nature of flowers, they are thrown away almost on a daily basis. The businesses dedication to their guarantee policy has resulted in the wastage of flower arrangements as the finished product waits in the store for pickup by the customer. The Flower Man stores their stock in plantation buckets which significantly reduces the potential lifespan of the flowers. Under normal temperature conditions, the stores flowers will last for a maximum of 5 days provided that the store keeper consistently maintains the products on a regular basis.

The following statistical analysis of the sales data was taken to achieve a better understanding of the purchasing patterns of The Flower Man customers.

Product	Average	Standard Deviation	CV
Roses	15	2.8	19%

The results of this analysis show that:

- Although there is a moderate fluctuation, the demand of roses is relatively stable (low CV of 19%)
- Rose's sale shows moderate seasonality during each week.
- Demand is low towards end of the week, and is high in the beginning of the week where Monday and Sunday have the highest demand

This systematically results in The Flower Man experiencing one of two negative outcomes:

Quantifying the Wastage Problem

A statistical measurement of The Flower Man's inventory deficit and surplus and wastage problem was undertaken, and it quantitatively reveals the extent to which these two problems exist in the business. To develop such a computation, the following process was held:

- Sales data was obtained from The Flower Man for roses
- Supplies data was inferred from information about daily deliveries of 20 roses
- Wastage in the number of flowers was calculated for each day, and total weekly wastage amount was calculated.

The extent of which the problem of inventory surpluses and deficits exist within The Flower Man are quantifiably illustrated in the table in the Appendix.

Using the data of rose wastage on a weekly basis, the surplus problem can be expressed in dollar figures; A rose costs \$3 per stem at The Flower Man.

Over a 10-week period, the wastage quantity of roses will be 36 on average per week. So, under the assumption of a 52-week period, the wastage of the flowers will be 188 on annual basis. Upon further calculations, a wastage expense of \$108 a week is revealed, or \$564 per year. This represents an unnecessary loss, which can be overcome easily. In the long run, by disposing inventory the business is unable to derive maximum use and efficiency from its resources. In fact, The Flower Man is also failing to generate a moderately high financial return from the investment.

RECOMMENDATIONS

The problems that The Flower Man is experiencing are due to poor inventory management based on the florist not knowing how much to order each day, resulting in excess stock which must be disposed of as wastage at the end of the day.

From our process analysis of The Flower Man sales data, more attention will be paid to achieve the two significant objectives of the inventory management process.

- 1) Reducing waste as much as possible
- 2) Increasing freshness and quality of the flowers.

In order to achieve the stated objectives, it is recommended that The Flower Man:

1) Install a refrigeration system

The installation of a refrigeration system increases the freshness and quality of the flowers, as well as extending the period of time the flowers will last.

As a result, this system will reduce waste costs significantly for the business due to reducing carrying costs and stock out costs. In addition, the approach of customer satisfaction will be easier to achieve with upholding the company's quality reputation.

2) Use the 'Periodic Review System' to forecast the daily order quantity

The implementation of a periodic review system on a daily basis will provide more accurate figures on quantity forecasting providing the florist with a better understanding of quantitative demand issues by provide a clearer disciplined approach to demand forecasting.

This method will be achieved by reviewing the sales data for the past ten weeks and identifying trends in the sales data to help better predict demand and modify order quantity accordingly. Through the analysis, a new order quantity will be set for each day of the week and the daily demand will dictate the quantity ordered.

The recommendations will result in the replacement of the end of day operations so that the following steps will be taken:

Step 7: The manager counts and records the quantity of stock left at the end of the day.

Step 8: The manager calculates the next day's order quantity using the 'Periodic Review System' formula.

Step 9: The manager then faxes an inventory order invoice to the Head Office for stock required in the next working day.

Step 10: All leftover flowers are stored in the refrigeration system for use the next day.

These changes are illustrated in the blueprint on the following page.

IMPLEMENTATION

Analysis of The Flower Man sales and inventory in a period of ten weeks has shown areas of improvement

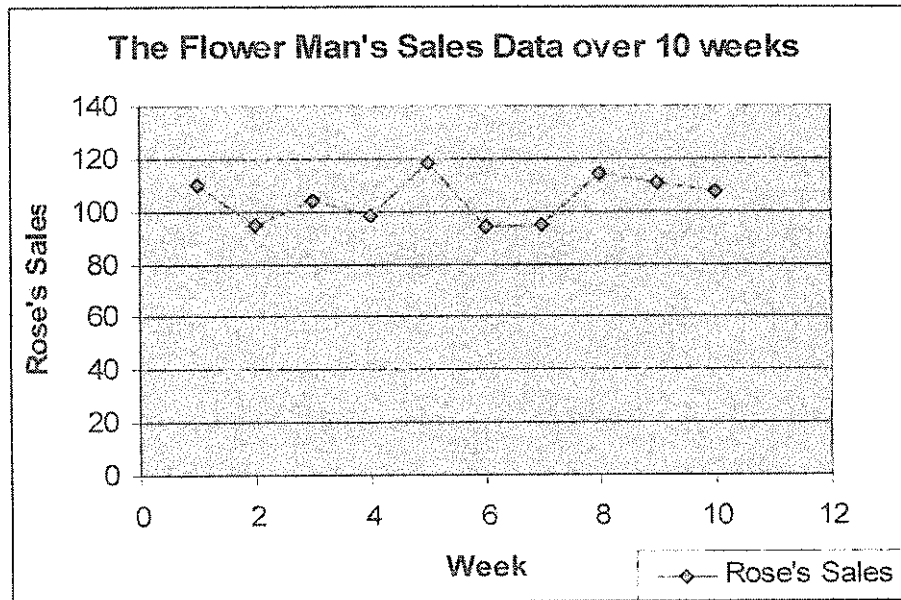
Storage Method	Plantation Buckets (in normal conditions)	Refrigeration System
Approximate life span of flowers	5 days	8 days

that could be made through the implementation of appropriate demand forecasting, cycle service levels and inventory control methods. The Flower Man had significant quantities of flowers being wasted at the end of trade due to the lack of storage and forecasting. Analysing the data of the florist gave insight into areas for improvement thus, providing the foundation to make implementations.

a. Demand Forecasting

The demand for the product is considered to be unpredictable on most weeks. Certain periods have elevated fluctuations such as Valentine's Day and Mothers Day etc whilst some days are extremely quiet. Although there is no definite trend there does appear to be a pattern of demand similar to that of a random component, this is because most flowers are bought and ordered on a Wednesday.

Graph 1. Sales results of Roses for a 10 week period.



Graphical interpretation above demonstrates the varied demand that occurs within the ten week period. therefore a Moving average approach of forecasting the sales data would be most appropriate in predicting demand for the next period.

The demand for roses each week has certain high and low periods, so the best approach for forecasting would be the moving average as it will have a greater level of accuracy. Moving average is the most appropriate approach as it eliminates historical data that is irrelevant compared to current data, it is useful in order to smooth out demands which have strong variations (Finch, 2006).

b. Cycle Service Level

It is recommended that 'The Flower Man' florist implements a 95% cycle service level due to the demographics of their consumers and high competition in the region. This will reduce stock outs and therefore satisfy demand. They will then be achieving the order winner for their customers who are able to receive the freshness, quality and quantity they seek.

The waiting time of deliveries is one day from supplier to customer. The average life of the flower lasts five days and through implementing the refrigeration systems we are able to reduce wastage of flowers and therefore increase CSL (cycle service level) from a 90% CSL to 95%. This will increase the quality of the flowers and the freshness therefore leading to increased accuracy in forecasting.

c. Inventory control

The main predicament with the florist's inventory control is the short life of the product as they do not have suitable storage systems implemented, therefore high levels of stock are thrown out. The proposal is for the implementation of refrigeration systems in the store will prolong the life of the flowers by an extra two to three days. The implementation of a periodic review approach will assist in helping to order the most accurate quantity according to the level of demand and in turn reducing wastage.

The periodic review formula is shown below.

Periodic Review formula

$$Q = (dOI + LT) + Z \cdot \sigma \cdot \sqrt{(OI+LT)} - A$$

dOI= demand multiplied by order interval (1 day)

LT= Lead time

Z= Z score (1.65 is a 95% CSL)
 σ = standard deviation
 A= Stock left over to be refrigerated

The proposed change will bring about inventory levels that are suited to the company and will optimistically follow the demand forecasted therefore reduce stock outs or wastage of flowers due to over ordering. (Niland & Powell, 1970)

d. Implementation

Implementing refrigeration systems we can compare the data produced below.

Table 1. Before implementation

Day	Roses Ordered	Roses Sold	Left Overs
Monday	20	12	8
Tuesday	20	13	7
Wednesday	20	15	5
Thursday	20	16	4
Friday	20	15	5
Saturday	40	14	26
Sunday	0	18	-18
<i>Total</i>			37

Table 1 illustrates the demand over a week in July for Roses the table shows the orders placed, sales and the wastage.

Table 2. After implementation

Day	Flowers Refrigerated	Roses Ordered	Roses Sold	Left Overs
Monday	0	23	12	11
Tuesday	11	10	13	8
Wednesday	8	13	15	6
Thursday	6	15	16	5
Friday	5	14	15	4
Saturday	4	16	14	6
Sunday	6	18	18	6
<i>Total</i>				6

Table 2. Subsequent to the implementation of refrigeration systems the table demonstrates the increased quantity of flowers refrigerated in order to increase the life from 5 days to 8 days, the orders placed that day, quantity sold and the quantity wasted.

RESULTS FROM IMPLEMENTATION

It is evident from table 2 that installing a refrigeration system and implementing the periodic review method for the florist has beneficial implications for the company in the short and long run.

The table below illustrates the situation after implementation. The wastage of flowers was reduced by thirty-one for the week, therefore nearly an 84% reduction for both the quantity and the total cost reduced, therefore confirming that after implementation it is better system to use then the current as costs also saved them \$93 on roses alone in one week. If there are notable savings on roses alone, the potential savings on the wide range of flowers at the florist will be immense. The new method of process using the 'Periodic Review System Formula' and the implementation of refrigeration systems has proven useful to significantly help the business reduce costs and control inventory.

Roses	Before the implementation	After the implementation	Difference between Before and After
Quantity of flower wastage over a week	37	6	31
Cost per flower	\$3	\$3	0
Total cost of wastage	\$111	\$18	\$93

Nevertheless, implementing the new system requires the company to expend extra time when placing the flowers in the refrigeration system and when calculating the order quantity using the periodic review system. Although these processes may seem tedious at first, with practice it will easily become routine, and time taken will be reduced.

CONCLUSION

After critically reviewing The Flower Man's current inventory processes with the management of flowers, it has led to the recommendation of implementing efficient and reliable strategies allowing the florist to improve its processes and operations management. By accounting for the level of wastage experienced by the company before implementation of our chosen process, The Flower Man will have the tools to function at the 95% CSL across the range of products provided by the organisation.

To achieve high profit turnover, a good inventory management process was required. Adopting a moving average and periodic review method as their demand forecasting strategy will provide accurate and reliable forecasts as it utilizes several demand values to develop a forecast and it also removes some of the forecast errors from historical data. Thus, the resultant forecast values are smoother, more stable and less variable than the times series itself.

In order to determine whether our proposed recommendations of the installation of the refrigeration system will be successful, it is necessary to monitor the florist's implementation. If the quality of the products are upheld, the company can achieve their ultimate goals of reducing wastage while maintaining its 'order winner' of high quality.

It is therefore highly conducive for the business to implement and control a good inventory system to maintain its competitiveness and value of the company. Actively engaging in efficient and reliable strategies based on forecasting, inventory control, and service level management will improve The Flower Man's processes significantly, enhancing company value performance and profitability.

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11. APPENDIX

Sales Data of Roses over a 10-week Period

Week	Month	Date	Day of Week	Quantity of Roses Ordered	Quantity of Roses Sold	Daily Wastage	Weekly Wastage
1	July	1	Sunday	20	15	5	
1	July	2	Monday	20	16	4	
1	July	3	Tuesday	20	20	0	

1	July	4	Wednesday	20	19	1	
1	July	5	Thursday	20	12	8	
1	July	6	Friday	20	17	3	
1	July	7	Saturday	20	11	9	30
2	July	8	Sunday	20	11	9	
2	July	9	Monday	20	18	2	
2	July	10	Tuesday	20	12	8	
2	July	11	Wednesday	20	10	10	
2	July	12	Thursday	20	18	2	
2	July	13	Friday	20	14	6	
2	July	14	Saturday	20	12	8	45
3	July	15	Sunday	20	19	1	
3	July	16	Monday	20	12	8	
3	July	17	Tuesday	20	13	7	
3	July	18	Wednesday	20	15	5	
3	July	19	Thursday	20	16	4	
3	July	20	Friday	20	15	5	
3	July	21	Saturday	20	14	6	36
4	July	22	Sunday	20	18	2	
4	July	23	Monday	20	12	8	
4	July	24	Tuesday	20	11	9	
4	July	25	Wednesday	20	14	6	
4	July	26	Thursday	20	15	5	
4	July	27	Friday	20	15	5	
4	July	28	Saturday	20	13	7	42
5	July	29	Sunday	20	17	3	
5	July	30	Monday	20	19	1	
5	Aug	31	Tuesday	20	17	3	
5	Aug	1	Wednesday	20	16	4	
5	Aug	2	Thursday	20	16	4	
5	Aug	3	Friday	20	16	4	
5	Aug	4	Saturday	20	17	3	22
6	Aug	5	Sunday	20	20	0	
6	Aug	6	Monday	20	12	8	
6	Aug	7	Tuesday	20	17	3	
6	Aug	8	Wednesday	20	11	9	
6	Aug	9	Thursday	20	13	7	
6	Aug	10	Friday	20	11	9	
6	Aug	11	Saturday	20	10	10	46
7	Aug	12	Sunday	20	11	9	
7	Aug	13	Monday	20	12	8	
7	Aug	14	Tuesday	20	16	4	
7	Aug	15	Wednesday	20	14	6	
7	Aug	16	Thursday	20	15	5	
7	Aug	17	Friday	20	12	8	
7	Aug	18	Saturday	20	15	5	45
8	Aug	19	Sunday	20	20	0	
8	Aug	20	Monday	20	19	1	

8	Aug	21	Tuesday	20	16	4	
8	Aug	22	Wednesday	20	16	4	
8	Aug	23	Thursday	20	12	8	
8	Aug	24	Friday	20	15	5	
8	Aug	25	Saturday	20	16	4	26
9	Aug	26	Sunday	20	14	6	
9	Aug	27	Monday	20	14	6	
9	Aug	28	Tuesday	20	14	6	
9	Aug	29	Wednesday	20	16	4	
9	Aug	30	Thursday	20	18	2	
9	Aug	31	Friday	20	17	3	
9	Aug	1	Saturday	20	18	2	29
10	Aug	2	Sunday	20	16	4	
10	Aug	3	Monday	20	20	0	
10	Aug	4	Tuesday	20	12	8	
10	Aug	5	Wednesday	20	16	4	
10	Aug	6	Thursday	20	19	1	
10	Aug	7	Friday	20	12	8	
10	Aug	8	Saturday	20	12	8	33

Table 1. Average demand and Standard Deviation of Roses after implementation

Supply Day	Average Demand	Standard Deviation
Monday	15.4	3.37
Tuesday	14.8	2.86
Wednesday	14.7	2.63
Thursday	15.4	2.5
Friday	14.4	2.11
Saturday	13.8	2.66
Sunday	16.1	3.35

Periodic Review Method Calculations

Example 1. Periodic Review Formula Monday Sold 12 units; wasted 8

Quantity = $(12 \times 1) + (1.65 \times 3.37 \times \sqrt{(1+1=2)}) - 8 = 12$ units

Example 2. Periodic Review Formula Tuesday Sold 13 units; wasted 7

Quantity = $(13 \times 1) + (1.65 \times 2.86 \times \sqrt{(1+1=2)}) - 7 = 13$ units

Example 3. Periodic Review Formula Monday Sold 15 units; wasted 5

Quantity = $(15 \times 1) + (1.65 \times 2.65 \times \sqrt{(1+1=2)}) - 5 = 17$ units